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Effects of Exchange Rate Volatility on Tourist Flows into Iceland

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Abstract

This paper examines the effect of Exchange Rate Volatility (ERV) for Iceland, on tourist arrivals exports during the period of first quarter of 1990 to fourth quarter of 2014. It is claimed by some researchers that exchange rate volatility causes a reduction on tourist arrivals. Empirical researchers often utilize the standard deviation of the moving average of the logarithm of the exchange rate as a measure of exchange rate fluctuation. In this study, a new measure for measuring volatility is proposed. The empirical methodology used relies upon the theory of cointegration, error correction representation of the exchange rate volatility measures using the Autoregressive Distributed Lags (ARDL) modeling to cointegration. Overall, our findings suggest that there is a negative effect of volatility to tourists' arrivals for Iceland.

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Keywords: Exchange Rate Volatility; tourism; Iceland; ARDL

1. Introduction

During the past decades many empirical researchers have attempted to model different sample countries' tourist flows. The fundamental aspect of this estimation has been the determination of a set of variables which will allow for the creation of more accurate models. As a result the selected variables often vary among sample countries since

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there are often fundamental differences among sample countries. Despite the differences among studies, our investigation will focus on one variable often overlooked in the literature. This variable is exchange rate volatility. The main argument of empirical researchers is that high exchange rate fluctuation can effect tour operations causing them to shift their business from a country with high exchange fluctuation to a country with low exchange rate fluctuation. Although the effect of exchange rate volatility has to some extent incorporated in empirical models through the utilisation of variables such as relative prices less attention has been given to measures of fluctuation of exchange rates among countries in tourism estimation models. The purpose of this paper is to explore the relationship between tourist flows and exchange rate volatility for Iceland.

The structure of the paper is as follows: Section 2, provides an overview of the relevant literature, Section 3, justifies the choice of the specific model and the choice of the variables. In section 4, data description and methodology issues are analysed. Section 5, presents our results and finally, Section 6, contains concluding remarks and analyses the policy implications of our findings**.**

2. Literature Review:

Although there has been some difference among selected variables determining exchange rates our investigation has uncovered a set of commonly utilized determinant variables. These variables are: a) the real effective exchange rate; b) the relative prices between destination and origin and c) the income, approximated by the GDP in PPS of set or major countries of tourists origin.

Empirical studies that investigate the impact of tourism have found that the devaluation of exchange rate at the country of destination attracts tourist flows while an exchange rate revaluation reduces tourism outflows (see e.g. among others Agiomirgianakis (2012); Garin-Munoz (2000) and Patsouratis, et. al. (2005)) adopting what Artus (1970) has suggested, namely, that travelers are more aware of exchange rates that they use and they are using them as proxy for the cost of living abroad. Researchers often suggest that the origin country income affects positively the inclination of people to travel. The cost of living at a destination relative to an origin, given by relative consumer prices between destination and origin is negatively related to tourism inflows (see, among others, Dwyer et al.2010 page 63-64). Transportation costs which is actually part of the overall cost of traveling to a destination, is negatively related in tourist flows see e.g. Agiomirgianakis (2012).

Some researchers have shed, some light into the effect of exchange rate volatility to tourist flows for example Patsouratis (2005) who shows that exchange rate fluctuations may be identified as the sole factor determining tourist flows, as the case of German tourism inflows in Greece. Fewer, however studies focus rather on the exchange rate volatility such as Webber (2001), Chang et al (2009), Yap (2012), Santana Gallego (2010). In a seminal paper by Webber (2001), the volatility of exchange rate is identified as a significant determinant of the long run tourism demand since in some cases exchange rate volatility might also be associated with political instability or social unrest in the destination country deterring tourists from this destination. In some cases according to Webber exchanger rate volatility may lead tourists to abandon the idea of travelling to a particular country in 40% of cases.

Recent studies such as Chiang et al (2009) initiated a further analysis into the effects of volatility of exchange rates showing that it is associated with the volatility into international tourist inflows in Taiwan. Yap (2012), initiated by the findings of Chiang et al (2009) in investigating whether exchange rate volatility results an increase in the uncertainty of tourist inflows into Australia, concludes that exchange rate volatility creates spillover effects on tourism arrivals in Australia though these effects may differ from stronger to weaker depending upon the sending country that creates these tourism inflows into Australia.

3. The Model

Our research examines the effects of exchange rate volatility on tourist arrivals for both the short run and long run periods. We utilise the auto regressive distributed lag (ARDL) methodology to estimate a reduced form tourist arrivals equation. This equation is composed of a set of commonly utilised independent variables among the literature and it is inclusive of two different measures of volatility as well a time trend and a set of seasonal dummy variables. The specification of the equation has been employed in Serenis and Tsounis (2014 and 2015) and is equation:

$$\ln X_t = \lambda_0 + \lambda_1 \ln\left(\frac{P_X}{P_w}\right)_t + \lambda_2 \ln GDP_t + \lambda_3 V_t + \lambda_4 D_1 + \lambda_5 D_3 + \lambda_6 D_4 + \lambda_7 \mathrm{T} + \omega_t \qquad (1)$$

Where tourist flows X is the number of tourist arrivals, P_X/P_w are real effective exchange rate indices between domestic country and the rest of the world (ROW), GDP is per capita GDP of the origin countries of tourists, measured in purchasing power parities (PPPs), V represents the two different measures of volatility, D1, D3, D4 are seasonal dummies, T is a time trend and ω is an error term.

The number of tourist arrivals consists of the total number or persons including residents and non residents arriving with sole purpose of tourism. The relative prices variable is constructed from the country's real effective exchange rate deflated by an index comprised of world real effective exchange for each country in our sample. The next variable in our equation is GDP per capita which has been calculated by weighting all the GDP's per capita values in purchasing power parities of the tourists' origin country. The weights have been calculated based on each origin country's total share to the destination country. Finally with regards to volatility we have employed two measures. The first measure (V1) is a moving average of the exchange rate and the second (V2) is a measure capturing the effects of high and low values of exchange rates.

One fundamental issues relating to this paper refers to the measurement of exchange rate volatility. Many empirical researchers have attempted to derive a comprehensive measure of exchange rate. However, exchange rate volatility is not directly observable thus; there is considerable ambiguity with regard to the determination of a volatility measurement. Empirical research have been for the most part utilize the standard deviation of the moving average of the logarithm of the exchange rate (see Serenis *et.al.* 2011, 2012, 2014, 2015, Agiomirgianakis *et.al.* 2014, 2015)

Due to the advantages that this measure provides it has been utilized by a variety of empirical researchers. However this measure can be associated with a variety of pitfalls which are often overlooked by empirical researchers. Economic theory often suggests that the effect of exchange rate can be attributed to unexpected changes which push the exchange rate to high and low values. As in most cases these values cannot be predicted resulting to a profound effect among tour operators and affecting tourist arrivals to these countries. A moving average measure has the ability to smooth out possible high and low values therefore reducing the overall actual effect of volatility. We examine two sets of estimated equations, in this study. The first, contains the standard deviation of the moving average of the logarithm of the real effective exchange rate as a measure of ERV (V1) and the second, contains a variable capturing the high and low values of the exchange rate (V2).

The second measure (V2), through the use of a dummy variable, is constructed to capture only the values for which the exchange rate fluctuates above and below a percentage of the average exchange rate value. Since we don't know for each country which values are perceived as high or low points we examine various cases for which the exchange rate increases above and below different certain thresholds ranging from 3%-7% and we will report the first statistically significant values that we obtain.

4. Data, Estimating Methodology and Results

This study examines the effects of ERV for Iceland. All the data are derived from Eurostat with the exception of the real effective exchange rate figures which are derived from IFS. Data is used from 1990q1 to 2014q4.

Before we proceed deeper in the analysis, we first test for the degree of integration among each one of the variables. The well-known Phillips-Perron (P-P) unit root test is utilized in our analysis and its's results are presented in table 1.

Table 1: Phillips-Peron unit root test results

series	Level	First difference	Second difference
lnX	-11.40897	-13.85632	-18.14555
lnGDP	-2.299144	-4.444496	-11.40419
V1	-102.5370	-219.3482	-178.8838
lnP	-2.130536	-8.811359	-20.72895
V2	-3.525760	-12.05955	-25.17895

Note: All tests are performed using the 5% level of significance; lnX is the logarithm of real aggregate export value, lnGDP represents the logarithm of a weighted index composed of the world countries, V1 is volatility measured as the moving average of the standard deviation of the exchange rate, V2 is the volatility measured as the moving average plus a moving average value capturing unexpected fluctuation of the exchange rate and lnP is the logarithm of an index capturing the country's relative prices to world's relative prices. All tests are performed to a maximum of three lags. The null hypothesis of a unit root is tested against the alternative. The asterisk denotes significance at least at 5% level.
Source: authors' calculations

For each variable the null hypothesis (H_0) of a unit root (non-stationarity) is tested against the alternative using the Bartlett Kernel estimation method. The null hypothesis is rejected in the first differences for: lnX, V1 and V2 and is concluded that there I(0) while lnGDP and lnP are I(1).

As suggested by Pesaran *et al.* (1999, 2001) the ARDL method can be applied in the case for which there is an existence of series of I(0) and I(1). In the event however, that any of the series is I(2) the ARDL method cannot be applied since it would produce spurious results (Oteng-Abayie et.al., 2006). According to the results of the Philips Peron which are presented in table 1 it is evident that none of our variables are I(2). As a result of this the ARDL method can be applied.

According to the ARDL methodology the estimated equation is:

$$\Delta lnX_t = a_0 + \vartheta lnX_{t-1} + \sum_{i=1}^{\mu} \theta_i G_{i,t-1} + \sum_{j=1}^{p} a_j \Delta lnX_{t-j} + \sum_{i=1}^{\mu}\sum_{j=0}^{p} \beta_{ij} \Delta G_{i,t-j} + \tau T + \delta_1 D1 + \delta_3 D3 + \delta_4 D4 + \omega_t \quad (2)$$

Where *Δ* represents the first difference operator and all of the variables are denoted as in section 3. As a result X represents tourist arrivals, P represents relative prices, GDP is the weighted per capita GDP in PP's of the origin countries, V1 and V2 represent the different measures of volatility accordingly. In addition, D1, D3, D4, T and are represent a set of seasonal dummies a time trend and a noise error term. Finally, μ=3 is the number of explanatory variable, ϑ, θ_i are the coefficients that represent the long-run relationship, α_j, β_{ij} are the coefficients that represent the short-run dynamics of the model and *p* is the number of lag length. Consistent with the ARDL methodology we will determine the lag order using the AIC selection criterion. Following the selection of the appropriate lag order we will than utilise the Lagrange Multiplier test (LM) in order to determine whether the errors of equation 3 for serial independence. Additionally the model will be tested for stationarity (*i.e.* dynamic stability). This condition will be satisfied in the event that the inverse roots of the AR polynomials lie inside the unit circle. On other important consideration of ARDL procedure is the existence of a long run relationship. We utilise the 'bounds testing' approach where the hypothesis of $H_0: \vartheta = \theta_1 = \cdots = \theta_i = 0$; *i.e.* the long-run relationship does not exist against the alternative $H_1: \vartheta \neq \theta_1 \neq \cdots \neq \theta_i \neq 0$. Finally in the event that cointegration exist in our model we than estimate and test for statistical significance the Error Correction Term (ECT).

Consistent with the ARDL methodology the error correction term, *e*, should contain a negative sign and have statistical significance. The value of the ECT is one of great importance since it allows us to determine the correction (in quarters) period between the dependent and explanatory variables.

Lastly the long run variables will have to be calculated. These long run variables will be obtained in a similar fashion to that described in Bardsen 1989 and will be calculated in the following way:

$$\hat{\gamma}_i = -\frac{\hat{\theta}_i}{\hat{\vartheta}} \quad (3);$$

Where $\hat{\theta}_i$ and $\hat{\vartheta}$ are the estimated long-run coefficients in equation (2). The $\hat{\gamma}_i$s show the responsiveness of the dependent variable, in our case the logarithm of tourist flows to changes in the long run of any explanatory variables. However, before we utilize these variables it is also important that we examine the degree of volatility associated with them (Gonzalez-Gomez *et.al.*, 2011). We will therefore utilize the Efron and Tibshirani (1998) the bootstrap method and calculate empirically confidence intervals without assuming a specific distribution of the γ_is. All results will be reported at 95% level of statistical significance.

5. The Results

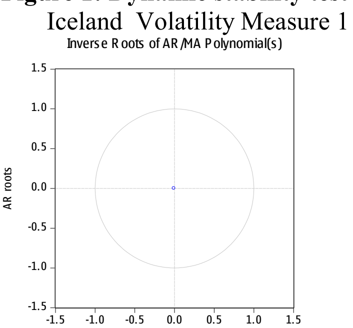
Consistent with the presentation of the ARDL methodology in section 4 the estimated lag length is (1,8,1,8), for the tourist flow model using volatility measure 1 and (1,2,8,8) for the model using volatility measure 2. The sequence of the numbers in parenthesis from left to right corresponds to *ln*X, *ln*P, *ln*GDP and V1 or *ln*V2 for the first number through the fourth. The regression results as well as the necessary diagnostic statistics such as the dynamic stability, the LM test and heteroscedasticity are presented in the Appendix. The long-run impact of exchange rate volatility on tourist flows is shown in Table 2 and it will be discussed below.

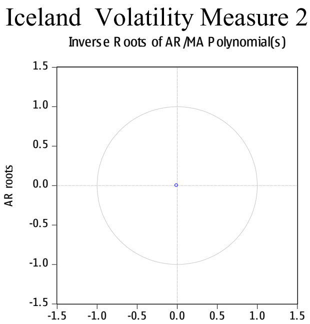
The results of the Lagrange Multiplier (LM) test suggest that the null hypothesis of no serial correlation of the error terms of equation 3 is not rejected. The F statistic of the LM test was 1.964 in the model with volatility measure 1 and 1.255 using volatility measure 2 which as discussed above was not significant. The results of the test are presented in column 4 in table of the appendix.

The Breusch-Pagan-Godfrey heteroskedasticity test was also performed (column 6 of the Table in the Appendix). The results of the F-statistic provided us with a value of 1.205, for measure 1; 1.047 for measure 2. However, none of the results where statistically significant leading us to conclude that the null hypothesis of homoschedasticity was failed to be rejected.

The next step is to examine the whether the AR model is dynamically stable. As described in section 4, when the inverse of the AR polynomials lie strictly inside the unit circle than a dynamically stable relationship exists. As presented in figure 1 for both models the inverse AR polynomials lie strictly inside the unit circle indicating a dynamically stable relationship.

Figure 1: Dynamic stability test





As mentioned previously in order to estimate the long run coefficients as well as the ECT it is necessary to examine for the existence of a long run relationship among the explanatory variables. We have tested for such a relationship by employing the Wald bounds test. The null hypothesis of no-cointegration is rejected against the alternative indicating the presence of cointegration among our sample. The F-statistic values of the test are (reported in column 3 table 2) 2, 10.80 for measure 1 and using measure 2 is 11.21. The test values higher than the upper bound of the critical values reported in table 2 column 4 and clearly indicate the presence of cointegration in our sample.

Table 2: Wald 'bounds test' and long-run impact of exchange rate volatility on tourist flows

	ARDL order	F-statistic, Wald bound test	Critical values for the F-statistic, lower and upper bound (from Perasan 2001)	$\hat{e}$	$\hat{\gamma}_i$	confidence intervals for $\hat{\gamma}_i$
Volatility measure 1	(1,8,1,8)	10.80462	4,066 -5,119	-0.9410	lnP: -1.088 lnGDP: 4.485 V1: -40.687	**[-1.951213 --.2261079]** **[1.764468 - 7.207393]** **[-65.51108 -15.86526]**
Volatility measure 2	(1,2,8,8)	11.20931	4,066 -5,119	-0.9046	lnP-0.414 lnGDP: 4.911 V2: -0.0017	**[-.6680854 -.1609705]** **[2.193852 7.629882]** **[-.0029057 -.000683]**

Notes: lnP represents the long run value of the ratio of the relative CPIs, lnGDP represents the logarithm of a weighted index composed of the sums of each country's real gross domestic per-capita product in PPP multiplied by the equivalent percentage of tourist arrivals of each country to Iceland, V1 represents the long run value of volatility measured as a moving average and V2 is the volatility capturing values above and below 6% of the average value of the moving average and P is the logarithm of the country's CPI to world's CPI; the asterisk indicates statistical significant coefficients at 5% level of statistical significance, the relevant confidence intervals are indicated in bold.
Note: All tests are performed using the 5% level of significance

After establishing, by the Wald test, that there is a cointegrating relationship, the coefficient of the Error Correction Term (ECT) and its statistical significance was estimated and they are presented in Table 2. Since we have determine the presence of cointegration thus, the existence of a long run relationship among the explanatory variables of our sample the next step is to estimate the Error Correction Term (ECT). As explained, the ECT must me negative and statistically significant and in our case is reported in table 2 column 5. The error correction term ECT, *e-hat*, is as it should negative and statistically significant indicating that there is co-integration between the dependent and the explanatory variables. Its value ranges from -0.94 for volatility measure 1 to – 0.90 for volatility measure 2. The value of the coefficient shows the percentage change of any disequilibrium between the dependent and the explanatory variables is corrected within one period (one quarter).

Having established a long run relationship among our variables, the calculation of the ECT we will also need to calculate the long run variables and test for their variability using the bootstrap method. The results of table 2 suggest that the $\hat{\gamma}_i$s that the dependent variable, in our case the logarithm of tourist arrivals, does respond to any change in the explanatory variables *i.e.* the logarithm of per-capita GDP of the countries of tourists origin, the logarithm of relative prices and the logarithm of the measure of exchange rate volatility. The statistical significance of the long-run coefficients is shown by the bootstrap confidence intervals (column 7). The examination of the long run volatility has a negative and statistically significant effect for both measures examined indicating that exchange rate volatility effects the decisions of the tour operators.

The remaining variables are as well statistically significant and with the expected signs. The per capita GDP is as expected positive and statistically significant for both models indicating that the income of the origin countries plays an important role in determining tourist arrivals. The relative price variable (P) is as expected negative and statistically significant indicating that the price levels between Iceland and the world does have a significant impact in determining tourist arrivals.

6. Conclusions

In this study the effect of exchange rate volatility has been examined to examine potential effects to tourist arrivals, an effect which is often overlooked by empirical researchers. As researchers for the most part utilize a moving average as their measure of volatility often overlooking the advantages of alternative measures, our empirical investigation consisted of two measures of exchange rate volatility. The employability of these measures allowed us to investigate unexpected high and low values of volatility to tourism arrivals for one country Iceland. Our empirical methodology relies upon the theory of cointegration, error correction representation of the cointegrated variables and different volatility measurements of the exchange rate. Over all our results suggest that there is a negative and statistically significant relationship from exchange rate volatility to exports in both the cases where a moving average and a variable capturing high and low measures of exchange rate to tourist arrivals.

In addition the elasticities of the visiting countries GDPs in PPs as expected do have a significant and positive effect to Iceland’s tourist flows. The coefficients are fairly high with a value larger than 5 indicating a significant magnitude of this effect as well. Relative prices as expected for the most part are negative and statistically significant. This result suggests that relative price levels between the origin country and Iceland does have an important and negative effect.

Overall our results have one important implication. This is that exchange rate volatility is a contributing factor to tourist arrivals. Both the moving average and the high and low measures of volatility have proven to have a significant effect to tourist arrivals. As a result researchers but most importantly policy makers should pay close attention to exchange rates when implementing policy designed to stimulate tourism. As different aspects of the exchange rate might effect tourism in different ways empirical researchers should utilize new measures which will allow them to isolate and examine additional effects of exchange rate to tourism.

Appendix: ARDL regression results (depended variable ΔX_t)

	ARDL order	Regressor, coefficient	F-statistic, LM test	Dynamic stability	Heteroskedasticity Test, F-statistic
Volatility measure 1	(1,8,1,8)	lnV1(-1)*: -49.95668 ln GDP(-1)*: 5.507980 lnX(-1)*: -1.227826 ln P(-1)*: -1.336684 Δ(ln(P(-1))): 1.607724 Δ(ln(P(-4)))** :0.985288 Δ(ln(P(-5)))**: 0.791311 Δ(ln(P(-6)))**: 0.681228 Δ(ln(P(-8)))**: -1.086851 Δ(ln(GDP))**: 4.223276 Δ(V1)**: -3.852 Δ(V1(-1))*: 38.12921 Δ(V1(-2))*: 36.05654 Δ(V1(-3))*:34.8 Δ(V1(-4))*:34.4 Δ(V1(-5))*:30.7 Δ(V1(-6))*: 26 Δ(V1(-7))*:23.5 Δ(V1(-8))*:11.8	1.964181	yes	1.205462
Volatility measure 2	(1,2,8,8)	lnV1(-1)*: -0.002786 ln GDP(-1)*: 7.625098 lnX(-1)*: -1.552438 ln P(-1)*: -0.643493 Δ(ln(X(-1)))*: 0.5106 Δ(ln(P(-1)))*: 0.645421 Δ(ln(GDP))*: 7.912302 Δ(ln(GDP(8)))* -6.8941 Δ(V2)*: -0.000618 Δ(V2(-1))*: 0.002652 Δ(V2(-2))*: 0.002272 Δ(V2(-3))*:0.002146 Δ(V2(-4))*:0.001521 Δ(V2(-5))*: 0.001557 Δ(V2(-6))*: 0.001113 Δ(V2(-7))*: 0.000923	1.255305	yes	1.047220

Notes: X represents the number of tourist arrivals, P represents the ratio of the relative CPIs, lnGDP represents the logarithm of a weighted index composed of the sums of each countries real gross per-capita domestic product in PPP multiplied by the equivalent percentage of tourist arrivals of each country to Iceland. V1 represents volatility measured as a moving average and V2 is volatility depicting values above and below 5% of the average value of the moving average. V1, V2 is in logarithmic form, as it can be seen from (2).The single asterisk denotes up to 5% and the double asterisk denotes up to 10% level of statistical significance. The plot of the inverse roots of the AR polynomials for examining the dynamic stability of the model are presented in Figure 1.

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